for adjusting a power level of the electron beam provided by the radiation source based on the absorbed radiation dose.

17. (New) The irradiation system of claim 16, wherein the radiation source further comprises a conversion plate for converting the electron beam into an x-ray beam as the electron beam exits that scan horn.

REMARKS

This is in response to the Office Action mailed on December 23, 2002, in which claims 1-15 were rejected under 35 U.S.C. § 102(e) as being anticipated by Korenev et al. (USP 6,429,444). With this Amendment, independent claims 1, 5, 11 and 12 have been amended to more clearly define the present invention, and dependent claim 9 has been amended for consistency.

In order to reject a claim under 35 U.S.C. § 102, each an every element as set forth in the claim must be found, either expressly or inherently described, in the prior art. See M.P.E.P. 2131, citing Verdegaal Bros. v. Union Oil Co. of California, 2 U.S.P.Q.2d (BNA) 1051, 1053 (Fed. Cir. 1987). As explained in detail below, the prior art of record does not disclose each of the elements of the amended claims, and the rejection of claims under 35 U.S.C. § 102 should accordingly be withdrawn.

Claims 1-4

Independent claim 1, as amended, recites a radiation source for providing a radiation beam having a controlled beam current, a current sensor coupled to the radiation source for measuring the beam current provided by the radiation source, a product location system for providing product so that the radiation beam impinges on the product, and a sensor system for measuring an intensity of the radiation beam that passes through the product. A control system calculates an intensity of the radiation beam provided by the radiation source based on the measured beam current. The control system also adjusts a power level of the radiation beam based on an absorbed radiation

dose which is based on a difference between the intensity of the radiation beam provided by the radiation source and the intensity of the radiation beam that passes through the product.

The Korenev et al. irradiation system includes a radiation source (10), an entrance sensor array (40a) for measuring the intensity of radiation entering an item to be processed, and an exit sensor array (40b) for measuring the intensity of radiation exiting the item. The outputs of the entrance sensor array (40a) and the exit sensor array (40b) are compared by a processor (54) to determine the radiation dose received by the item.

The present invention, as recited in amended claim 1, is able to determine an absorbed radiation dose without having to provide an entrance sensor. Instead of employing an entrance sensor, the present invention utilizes a current sensor coupled to the radiation source for measuring the beam current provided by the source. The control system of the present invention then calculates an intensity of the radiation beam provided by the radiation source based on the measured beam current, and adjusts a power level of the radiation bean provided by the radiation source based on an absorbed radiation dose, which is based on a difference between the intensity of the radiation beam provided by the radiation source and the intensity of the radiation beam that passes through the product.

The claimed current sensor coupled to the radiation source for measuring the beam current provided by the source is not disclosed by Korenev et al. Moreover, Korenev et al. do not disclose a control system that calculates an intensity of a radiation beam provided by a radiation source based on this measured beam current, as recited in amended claim 1. By contrast, Korenev et al. teach the use of an entrance sensor for measuring radiation intensity entering an item to be processed and an exit sensor for measuring radiation intensity exiting the item. Since Korenev et al. do not disclose each and every element of amended claim 1, the rejection of claim 1 under 35 U.S.C. § 102(e) should be withdrawn.

Claims 2-4 depend from amended independent claim 1, and are allowable therewith.

Claims 5-10

Independent claim 5, as amended, recites a radiation source for providing a radiation beam at a first controlled intensity, the radiation beam having a beam current and having at least an x-ray component with a second intensity that is proportional to the first intensity, a current sensor coupled to the radiation source for measuring the beam current provided by the radiation source, a product location system for advancing the product past the radiation beam at a controlled speed, so that the radiation beam impinges on the product, and a sensor system for measuring a third intensity of a portion of the x-ray component of the radiation beam that passes through the product. A control system calculates the second intensity of the x-ray component of the radiation beam based on the measured beam current provided by the radiation source, and adjusts the first intensity of the radiation beam based on an absorbed radiation dose, which is based on a difference between the third intensity of the portion of the x-ray component of the radiation beam that passes through the product and the second intensity of the x-ray component of the radiation beam.

As discussed above with respect to claim 1, Korenev et al. do not disclose a current sensor coupled to the radiation source for measuring the beam current provided by the source, and also do not disclose a control system that calculates an intensity of an x-ray component of a radiation beam provided by a radiation source based on this measured beam current. By contrast, Korenev et al. teach the use of an entrance sensor for measuring radiation intensity entering an item to be processed and an exit sensor for measuring radiation intensity exiting the item. Since Korenev et al. do not disclose each and every element of amended claim 5, the rejection of claim 5 under 35 U.S.C. § 102(e) should be withdrawn.

Claims 6-10 depend from amended independent claim 5, and are allowable therewith.

Claim 11

Independent claim 11, as amended, recites a radiation source for providing a radiation beam having a beam current and having a first intensity profile, the radiation beam having at least an x-ray component with a second intensity profile that is proportional to the first intensity profile. A current sensor is coupled to the radiation source for measuring the beam current provided by the

radiation source. A product location system provides product so that the radiation beam impinges on the product, and a sensor system measures a third intensity of a portion of at least part of the x-ray component of the radiation beam that passes through the product. A control system calculates the second intensity o the x-ray component of the radiation beam based on the measured beam current, and interprets measurements taken by the sensor system to determine a relative location and type of the product that the radiation beam impinges upon. The control system is responsive to the determined relative location and type of the product to adjust at least one of the first intensity profile of the radiation beam, a location pattern of successive radiation beams, and a speed of advancement of the product by the product location system.

As discussed above with respect to claims 1 and 5, Korenev et al. do not disclose a current sensor coupled to the radiation source for measuring the beam current provided by the source, and also do not disclose a control system that calculates an intensity of an x-ray component of a radiation beam provided by a radiation source based on this measured beam current. By contrast, Korenev et al. teach the use of an entrance sensor for measuring radiation intensity entering an item to be processed and an exit sensor for measuring radiation intensity exiting the item. Since Korenev et al. do not disclose each and every element of amended claim 11, the rejection of claim 11 under 35 U.S.C. § 102(e) should be withdrawn.

Claims 12-15

Independent claim 12, as amended, recites a method of irradiating product that includes providing a radiation beam having a controlled beam current, measuring the beam current of the radiation beam, directing the radiation beam onto product, and measuring an intensity of a portion of the radiation beam that passes through the product. An intensity of the provided radiation beam is calculated based on the measured beam current, and the beam current of the provided radiation beam is adjusted in order to adjust the intensity of the radiation beam, based on a difference between the measured intensity of the portion of the radiation beam that passes through the product and the calculated intensity of the provided radiation beam.

As discussed above with respect to claims 1, 5 and 11, Korenev et al. do not disclose measuring the beam current of the radiation beam, and also do not disclose calculating an intensity of the provided radiation beam based on this measured beam current. By contrast, Korenev et al. teach the use of an entrance sensor for measuring radiation intensity entering an item to be processed and an exit sensor for measuring radiation intensity exiting the item. Since Korenev et al. do not disclose each and every element of amended claim 12, the rejection of claim 12 under 35 U.S.C. § 102(e) should be withdrawn.

Claims 13-15 depend from amended independent claim 12, and are allowable therewith.

New Claims

With this Amendment, new claims 16 and 17 have been added to further claim the present invention. Independent claim 16 recites a radiation source that includes a current sensor coupled to an accelerator to measure an electron beam current. A control system calculates a first radiation dose based on the measured beam current, a second radiation dose based on the intensity of radiation that passes through the product being treated, and an absorbed dose based on the difference between the first radiation dose and the second radiation dose. The power level of the electron beam is then adjusted based on the absorbed dose. As discussed above with respect to claims 1, 5, 11 and 12, the prior art of record does not disclose such a configuration. Specifically, Korenev et al. disclose an entrance sensor that is located immediately adjacent a point where the electron beam enters product to be irradiated. This arrangement requires knowledge of the destination for the electron beam in order to measure the intensity of the electron beam and equivalent radiation dose of the beam. By contrast, the current sensor recited in claim 16 is part of the radiation source, measuring the beam current of the electron beam before that beam is even shaped and directed. The claimed control system then calculates the equivalent radiation dose based on the measured beam current. Claim 17 depends from claim 16. Consideration and allowance of new claims 16 and 17 is respectfully requested.

CONCLUSION

In view of the foregoing, all pending claims 1-17 are in condition for allowance. A notice to that effect is respectfully requested. The Examiner is cordially invited to contact the undersigned at the telephone number listed below if such a call would in any way facilitate the allowance of this application.

Respectfully submitted,

KINNEY & LANGE, P.A.

Date: March 4, 2003

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APPENDIX: MARKED UP VERSION OF SPECIFICATION AND CLAIM AMENDMENTS

1. (Amended) An irradiation system comprising:

a radiation source for providing a radiation beam having [at] a controlled [power level] beam current;

a current sensor coupled to the radiation source for measuring the beam current provided by the radiation source;

a product location system for providing product so that the radiation beam impinges on the product;

a sensor system for measuring an intensity of the radiation beam that passes through the product; and

a control system for calculating an intensity of the radiation beam provided by the radiation source based on the measured beam current, and for adjusting a power level of the radiation beam provided by the radiation source based on an absorbed radiation dose which is based on a difference between the intensity of the radiation beam provided by the radiation source and the intensity of the radiation beam that passes through the product.

5. (Amended) An irradiation system comprising:

a radiation source for providing a radiation beam at a first controlled intensity, the radiation beam having a beam current and having at least an x-ray component with a second intensity that is proportional to the first intensity;

a current sensor coupled to the radiation source for measuring the beam current provided by the radiation source;

a product location system for advancing the product past the radiation beam at a controlled speed, so that the radiation beam impinges on the product;

a sensor system for measuring [an] a third intensity of a portion of the x-ray component of the radiation beam that passes through the product;

a control system for calculating the second intensity of the x-ray component of the radiation beam based on the measured beam current provided by the radiation source, and for adjusting the first intensity of the radiation beam based on an absorbed radiation dose which is based on a difference between the third intensity of the portion of the x-ray component of the radiation beam that passes through the product and the second intensity of the x-ray component of the radiation beam.

APPENDIX:
MARKED UP VERSION OF SPECIFICATION AND CLAIM AMENDMENTS

9. (Amended) The irradiation system of claim 8, wherein the sensor system further includes an attenuator plate for scaling the <u>third</u> intensity of the portion of the x-ray component of the radiation beam that passes through the product to correspond with a dynamic range of the linear x-ray sensor array.

11. (Amended) An irradiation system comprising:

a radiation source for providing a radiation beam having <u>a beam current and having</u> a first intensity profile, the radiation beam having at least an x-ray component with a second intensity profile that is proportional to the first intensity profile;

<u>a current sensor coupled to the radiation source for measuring the beam current provided by the radiation source;</u>

a product location system for providing product so that the radiation beam impinges on the product;

a sensor system for measuring [an] <u>a third</u> intensity of a portion of at least part of the x-ray component of the radiation beam that passes through the product;

a control system for <u>calculating the second intensity profile of the x-ray component of the radiation beam based on the measured beam current provided by the radiation source, and for</u> interpreting measurements taken by the sensor system to determine a relative location and type of the product that the radiation beam impinges upon, the control system being responsive to the determined relative location and type of the product to adjust at least one of the first intensity profile of the radiation beam, a location pattern of successive radiation beams, and a speed of advancement of product by the product location system.

12. (Amended) A method of irradiating product, comprising:

providing a radiation beam <u>having a controlled beam current</u>;

<u>measuring the beam current of the radiation beam;</u>

directing the radiation beam onto product;

measuring an intensity of a portion of the radiation beam that passes through the product;

<u>calculating an intensity of the provided radiation beam based on the measured beam current;</u> and

adjusting the [intensity of the] <u>beam current of the provided</u> radiation beam <u>to adjust its intensity,</u> based on a difference between the <u>measured</u> intensity of the portion of the radiation beam that passes through the product and the <u>calculated</u> intensity of the <u>provided</u> radiation beam [itself].